



ME Department Seminar

Impulse Welding and Manufacturing: Methods and Opportunities



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Abstract

Explosive-like impulse can do remarkable things. Impact welding, for example can produce very strong welds between wildly dissimilar metals in a solid-state process, avoiding the intermetallic compounds that often cause brittleness, and melting that can destroy microstructure and strength. Explosive forming can dramatically extend forming limits and can avoid presses and fixed dies. This presentation will discuss many ways that explosive-like methods can be used in conventional lab or factory environments. Methods to be considered include: chemical explosives, electromagnetic Lorentz interaction, vaporizing metal foils or filaments, laser impulse, and high speed presses.

While these methods can offer vastly different pressure-time profiles with pressures ranging to GPa and time scales to tens of nanoseconds, all these methods offer opportunities very light equipment and enable new phenomena that can enable new methods of joining, forming, cutting and surface treatment. The operations discussed will include: solid state impact welding, conformal joining, forming, shearing, surface hardening, and powder consolidation.

After a brief, but broad introduction to impulse manufacturing, we focus on the use of the new methods of the vaporizing foil technique and laser impulse methods to enable solid-state welding and athermal stress relief. Modeling and simulation will be synthesized with experimental macroscopic and microstructural information. Efforts to further commercialize these methods will also be discussed.

Bio

Glenn Daehn's research, education and service efforts are all broadly related to the interwoven themes of Midwestern manufacturing revival, which in turn depends on technology development, integration of The Ohio State University mission with regional industry and the development of a world-class workforce that is both smart and creative as well as able to make things.